Radioactivity in the Risø District January-June 2014

Nielsen, Sven Poul; Andersson, Kasper Grann; Miller, Arne

Publication date:
2014

Document Version
Publisher's PDF, also known as Version of record

Radioactivity in the Risø District January-June 2014

DTU Nutech Report

Sven P. Nielsen, Kasper G. Andersson and Arne Miller
DTU-Nutech-9(EN)
December 2014

DTU Nutech
Center for Nuclear Technologies

Author: Sven P. Nielsen, Kasper G. Andersson and Arne Miller
Title: Radioactivity in the Risø District January-June 2014
Center for Nuclear Technologies

DTU-Nutech-9(EN)
December 2014

Abstract (max. 2000 char.): The environmental surveillance of the Risø environment was continued in January-June 2014. The mean concentrations in air were: 0.47±0.45 μBq m^{-3} of ^{137}Cs, 2.96±1.33 mBq m^{-3} of ^{7}Be and 0.27±0.24 mBq m^{-3} of ^{210}Pb (±1 S.D.; N = 26). The depositions by precipitation at Risø in the first half of 2013 were: 0.086 Bq m^{-2} of ^{137}Cs, 433 Bq m^{-2} of ^{7}Be, 39.9 Bq m^{-2} of ^{210}Pb and < 0.8 kBq m^{-2} of ^{3}H. The average background dose rate (TLD) at Risø (Zone I) was measured as 107 nSv h^{-1} compared with 91 ± 6 nSv h^{-1} (±1 S.D.; N = 4) in the four zones around Risø.

The TLD measurement results for this reporting period show a greater background level than normally expected. This is probably caused by unresolved measurement problems, and work is ongoing to identify and solve these problems.

ISBN 978-87-995321-9-3

Contract no.:

Group's own reg. no.:
59514 E-1

Sponsorship:

Cover :

Pages: 24
Tables: 14
References:

Center for Nuclear Technologies
Technical University of Denmark
P.O.Box 49
DK-4000 Roskilde
Denmark
Telephone +45 46774173
kgan@dtu.dk
www.risoe.dtu.dk

Contents

Table 1. Radionuclides in ground level air collected at Risø (cf. Figs. 1, 1.1 and 1.2), January - June 2014. (Unit: μBq m^{-3})

Date		^{7}Be	^{137}Cs	^{210}Pb
30-Dec-14 –	07-Jan-14	2276	0.312	136
07-Jan-14 –	13-Jan-14	1287	0.092	67
13-Jan-14 –	27-Jan-14	3244	0.798	316
27-Jan-14 –	11-Feb-14	2688	0.738	458
11-Feb-14 –	17-Feb-14	2604	0.242	42
17-Feb-14 –	24-Feb-14	1996	0.340	158
24-Feb-14 –	03-Mar-14	2846	0.834	826
03-Mar-14 –	10-Mar-14	4957	1.280	894
10-Mar-14 –	17-Mar-14	2515	0.357	154
17-Mar-14 –	24-Mar-14	2343	0.119	117
24-Mar-14 –	01-Apr-14	3747	0.606	226
01-Apr-14 –	07-Apr-14	2176	0.205	104
07-Apr-14 –	14-Apr-14	1144	0.153	77
14-Apr-14 –	22-Apr-14	2571	0.947	178
22-Apr-14 –	28-Apr-14	6859	1.805	347
28-Apr-14 –	05-May-14	5785	0.924	375
05-May-14 –	12-May-14	3290	0.164	171
12-May-14 –	20-May-14	2749	0.139	184
20-May-14 –	27-May-14	3926	0.248	371
27-May-14 –	02-Jun-14	3054	0.221	168
02-Jun-14 –	10-Jun-14	2193	0.141	149
10-Jun-14 –	16-Jun-14	2641	0.172	116
16-Jun-14 –	23-Jun-14	2089	0.097	703
23-Jun-14 –	30-Jun-14	2018	0.112	132
Mean		2958	0.467	269
SD		1325	0.452	235

Table 2.1. Radionuclides in precipitation in the 10 m^2 rain collector at Risø (cf. Fig. 1), January - June 2014. (Unit: Bq m^{-3})

Month	^{7}Be	^{137}Cs	^{210}Pb
January	1908	0.252	176
February	1887	0.113	114
March	1076	0.188	171
April	1978	1.335	183
May	1037	0.144	70
June	4297	0.720	469

Table 2.2. Radionuclides in precipitation in the 10 m^2 rain collector at Risø (cf. Fig. 1), January - June 2014. (Unit: Bq m^{-2})

Month	Precipitation (m)	^{7}Be	^{137}Cs	^{210}Pb
January	0.057	108.1	0.0143	10.0
February	0.030	57.5	0.0034	3.7
March	0.015	16.4	0.0029	2.6
April	0.025	50.1	0.0338	4.7
May	0.070	72.6	0.0101	4.9
June	0.029	127.9	0.0214	14.0
Sum	0.226	432.6	0.0859	39.9

Table 2.3. Tritium in precipitation collected at Risø (cf. Figs. 1, 2.3.1 and 2.3.2). January - June 2014. (Unit: kBq m^{-3})

Month	1 m^2 rain collector*#	10 m^2 rain collector*
January	< 3.0	< 3.0
February	< 3.0	< 3.0
March	-	< 3.0
April	-	< 3.0
May	-	< 3.0
June	-	6.0

Double determinations*.

Note: From March 2014 the 1m^2 rain collector is no longer in operation.

Table 2.4. Tritium in precipitation collected at Risø (cf. Fig. 1). January - June 2014. (Unit: kBq m^{-2})

Month	Precipitation (m)	1 m^2 rain collector#	10 m^2 rain collector
January	0.057	< 0.171	< 0.171
February	0.030	< 0.090	< 0.090
March	0.015	-	< 0.045
April	0.025	-	< 0.075
May	0.070	-	< 0.210
June	0.029	-	< 0.174
Sum	0.226	-	< 0.765

Note: From March 2014 the 1m^2 rain collector is no longer in operation.

Table 3.1. Radionuclides in sediment samples collected at Bolund in Roskilde Fjord.(cf. Fig. 3.1) January - June 2014. (Unit: Bq kg^{-1} dry)

No samples in this period.

Table 4.1. Radionuclides in seawater collected in Roskilde Fjord (cf. Fig. 4.1) January - June 2014. (Unit: Bq m^{-3})

No samples in this period.

Table 4.2. Tritium in seawater collected in Roskilde Fjord (Risø pier) (cf. Fig. 4.2) January - June 2014.

Month	kBq m^{-3}
March	< 3.0 *
June	< 3.0 *
* Double determinations	

Table 5.1. Radionuclides in grass (snow) collected at Risø (near the Waste Treatment Station (cf. Fig. 1)), January - June 2014. (**Measured on bulked ash samples)*

Week no. or month	Date	K (g kg^{-1} fresh)	^{137}Cs (Bq kg^{-1} fresh)	^{137}Cs (Bq m^{-2})
1	1 January	2.0	<0.2	
3	13 January	1.8	<0.3	
5	27 January	2.2	<1.0	
7	10 February	5.3	<1.6	
9	24 February	3.3	<1.2	
11	10 March	3.8	<2.0	
13	24 March	5.0	<1.0	
15	7 April	3.4	<0.5	
17	22 April	6.0	<0.8	
19	5 May	6.3	<0.5	
21	19 May	3.6	<0.3	
23	2 June	6.2	<0.5	
25	16 June	6.3	<0.5	
**January			0.263	0.070
**February			0.790	0.127
**March			0.446	0.034
**April			0.181	0.039
**May			0.043	0.016
**June			-	-

Table 5.2. Radionuclides in Fucus vesiculosus collected at Bolund in Roskilde Fjord. January - June 2014. (Unit: Bq kg^{-1} dry)

No samples in this period.

Table 7.1. Waste water collected at Risø (cf. Fig. 1), January - June 2014.

Week number	eqv. mg KCl l^{-1}	^{137}Cs (Bq m^{-3})	^{131}I (Bq m^{-3})	^{226}Ra (Bq m^{-3})
1	78	201	<108	<218
2	72	<89	<75	<158
3	40	<113	<285	<220
4	46	<109	<117	<237
5	50	<118	<122	<238
6	47	<105	<110	<206
7	59	<105	<115	<206
8	55	<123	<132	<232
9	84	<108	<112	<205
10	85	<123	<117	<241
11	92	<104	<114	<203
12	91	<99	<106	<197
13	82	<81	<86	<155
14	77	<109	<114	<224
15	82	<111	<112	<223
16	84	<106	<108	<209
17	87	<107	<110	<217
18	95	<120	<135	<277
19	144	<181	<87	<160
20	79	<108	<117	<228
21	85	<113	<121	<218
22	85	<142	<154	<327
23	78	<112	<112	<210
24	96	<108	<110	<214
25	99	<124	<118	<236
26	92	<119	<117	<216
Mean	79.4	< 117	<120	<219
SD	21.3			

Table 8.1. Background dose rates around the border of Risø (cf. Fig. 8.1) measured with thermoluminescence dosimeters (TLD) in the period November 2013 – April 2014. (Results are normalized to nSv h^{-1})

Location	nSv h^{-1} ¤
1	170
2	75
3	66
4	74
5	91
6	111
Mean	98

¤ The TLD measurement results for this reporting period show a greater background level than normally expected. This is probably caused by unresolved measurement problems, and work is ongoing to identify and solve these problems.

Table 8.2. Background dose rates around Risø (cf. Fig. 8.2 and Fig. 1) measured with thermoluminescence dosimeters (TLD) in the period November 2013– April 2014. (Results are normalized to nSv h^{-1}),

Risø zone	Location	nSv h^{-1} ¤
I	1	98
I	2	88
I	3	109
I	4	148
I	5	93
Mean		107
II	P1	116
II	P2	89
II	P3	73
II	P4	108
Mean		97
III	P1	77
III	P2	107
III	P3	84
Mean		89
IV	P1	65
IV	P2	94
IV	P3	94
IV	P4	82
IV	P5	78
IV	P6	70
IV	P7	104
Mean		84
V	P1	90
V	P2	87
V	P3	97
V	P4	86
V	P5	105
V	P6	70
V	P7	120
V	P8	101
V	P9	79
V	P10	94
Mean		93

Table 8.3. Terrestrial dose rates at the Risø zones (cf. Fig. 8.2 and Fig. 1) July - December 2014. Measured with a NaI(Tl) detector. (Unit: nSv h^{-1})

Risø zone	Location	October
I	P1	43
I	P2	54
I	P3	390
I	P4	48
I	P5	46
Mean		116
II	P1	47
II	P2	49
II	P3	44
II	P4	43
Mean		46
III	P1	48
III	P2	51
III	P3	46
Mean		48
IV	P1	38
IV	P2	46
IV	P3	45
IV	P4	46
IV	P5	32
IV	P6	45
IV	P7	44
Mean		42
V	P1	42
V	P2	56
V	P3	58
V	P4	49
V	P5	49
V	P6	49
V	P7	43
V	P7a	48
V	P8	50
V	P9	52
V	P10	42
Mean		49

Fig. 1. Locations for measurements of gamma-background radiation Zone I and II (cf. Tables 8.2 and 8.3)

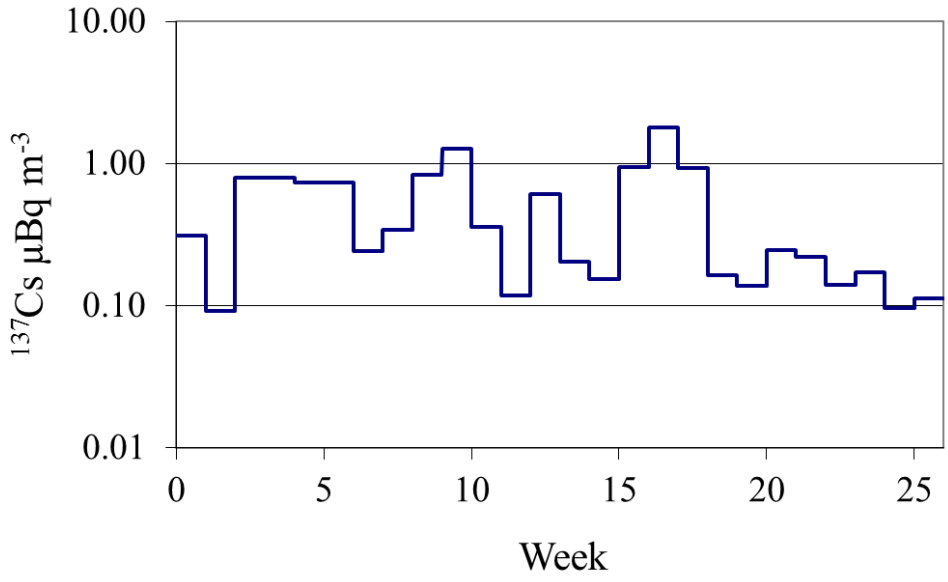

Fig. 1.1. Caesium-137 in ground level air collected at Risø in January-June 2014. (Unit: µBq m^{-3})

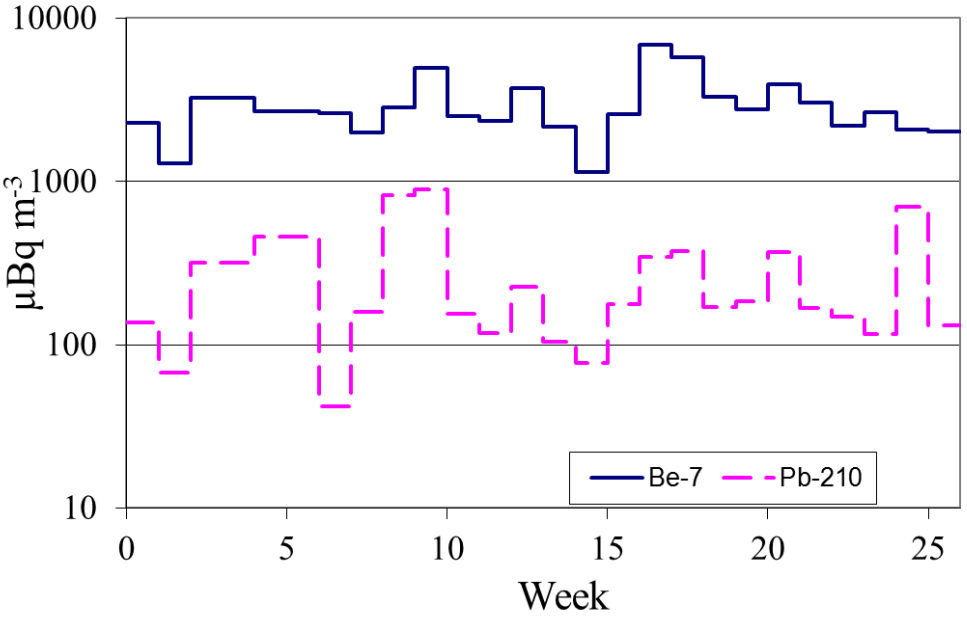

Fig. 1.2. Beryllium-7 and Lead-210 in ground level air collected at Risø in January-June 2014. (Unit: µBq m^{-3})

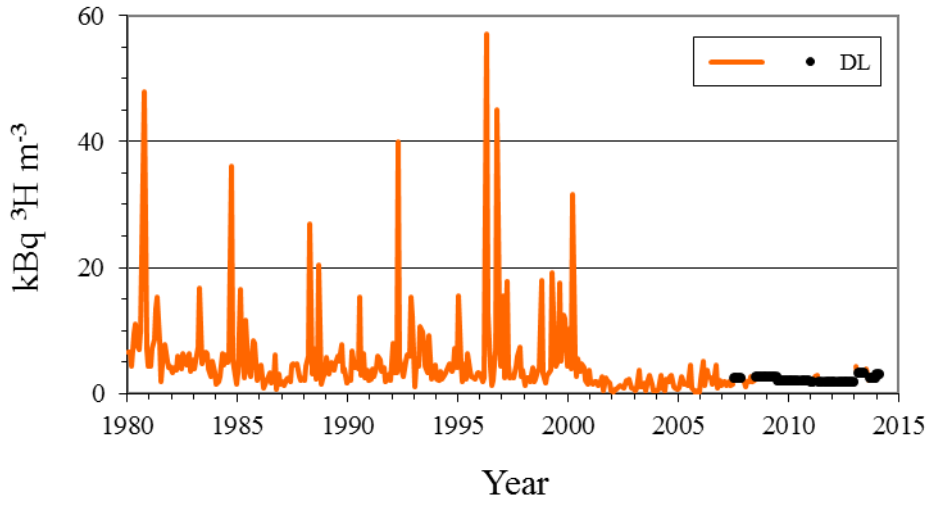

Fig. 2.3.1. Tritium in precipitation collected at Risø (1 m^2 rain collector) 1980 - 2014. (Unit: kBq m^{-3}; DL = detection limit)

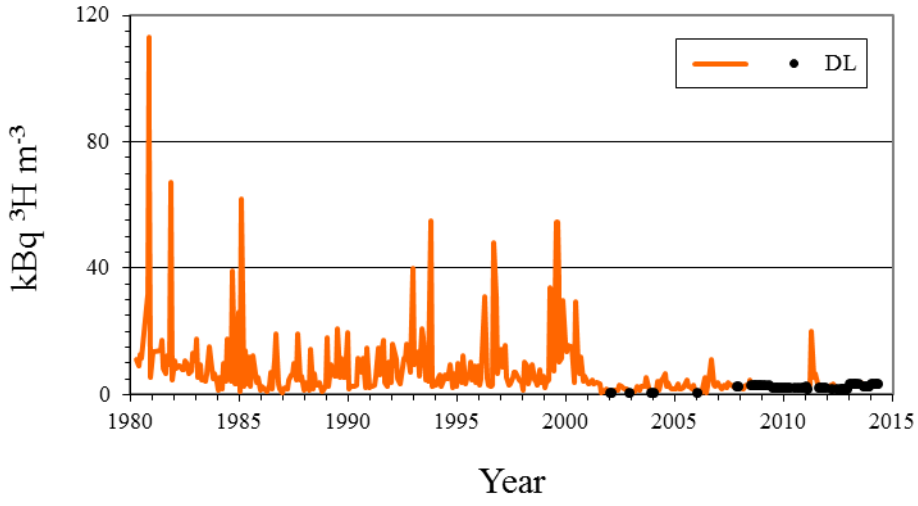

Fig. 2.3.2. Tritium in precipitation collected at Risø (10 m^2 rain collector) 1980 - 2014. (Unit: kBq m^{-3}; DL = detection limit)

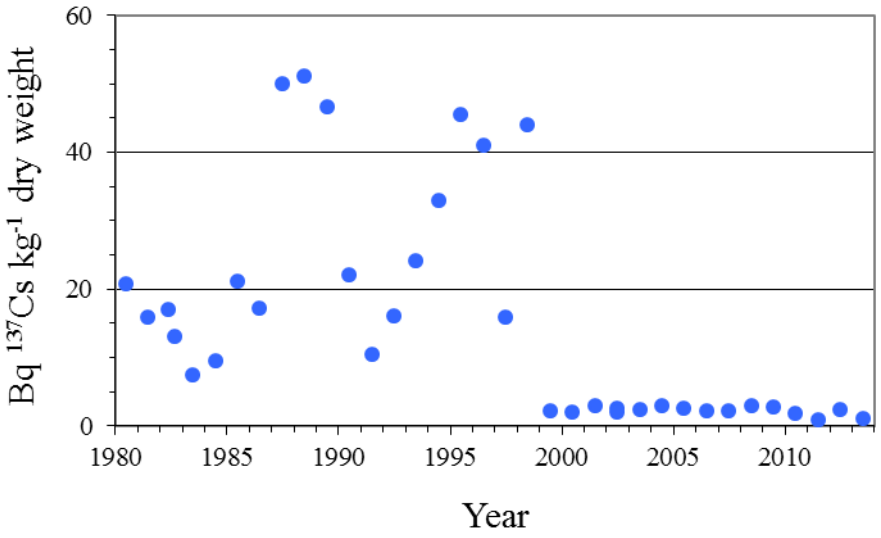

Fig. 3.1. Caesium–137 in sediment samples collected at Bolund in Roskilde Fjord. 1980 – 2014. (Unit: Bq kg^{-1} dry matter)

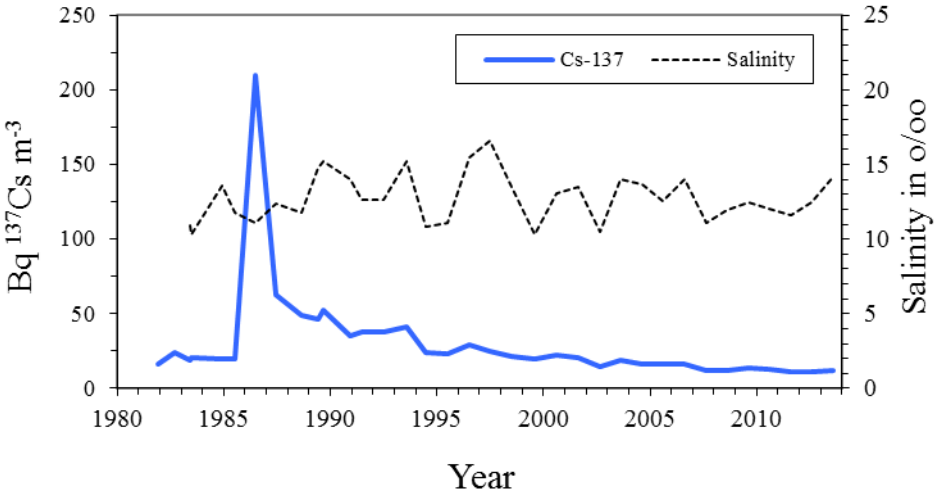

Fig. 4.1. Caesium–137 in seawater collected in Roskilde Fjord 1980 - 2014. (Unit: Bq m^{-3})

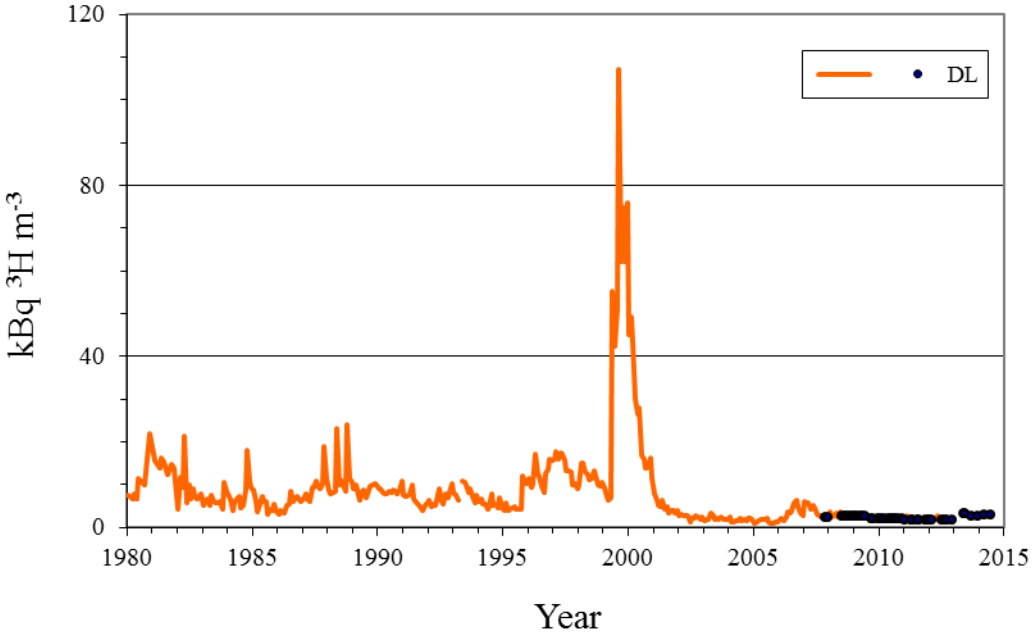

Fig. 4.2. Tritium in seawater collected in Roskilde Fjord 1980 - 2014. (Unit: kBq m^{-3}; DL = detection limit)

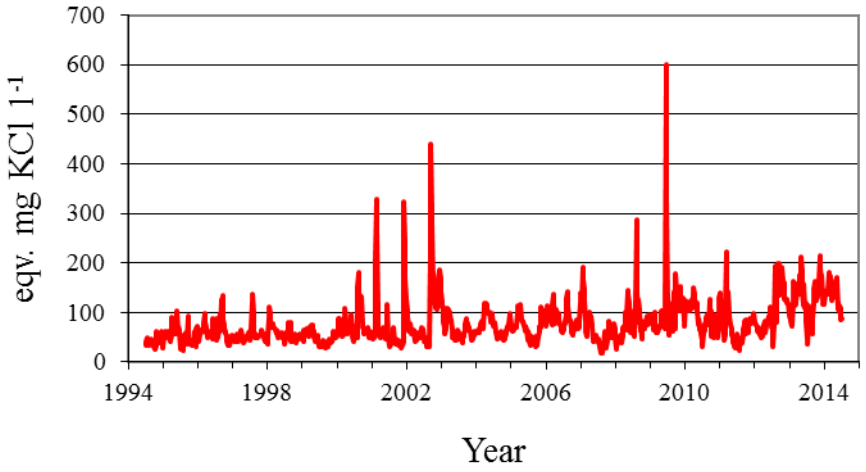

Fig. 7.1. Total-beta radioactivity in waste water collected at Risø 1994 - 2014. (Unit: eqv. mg KCl l^{-1})

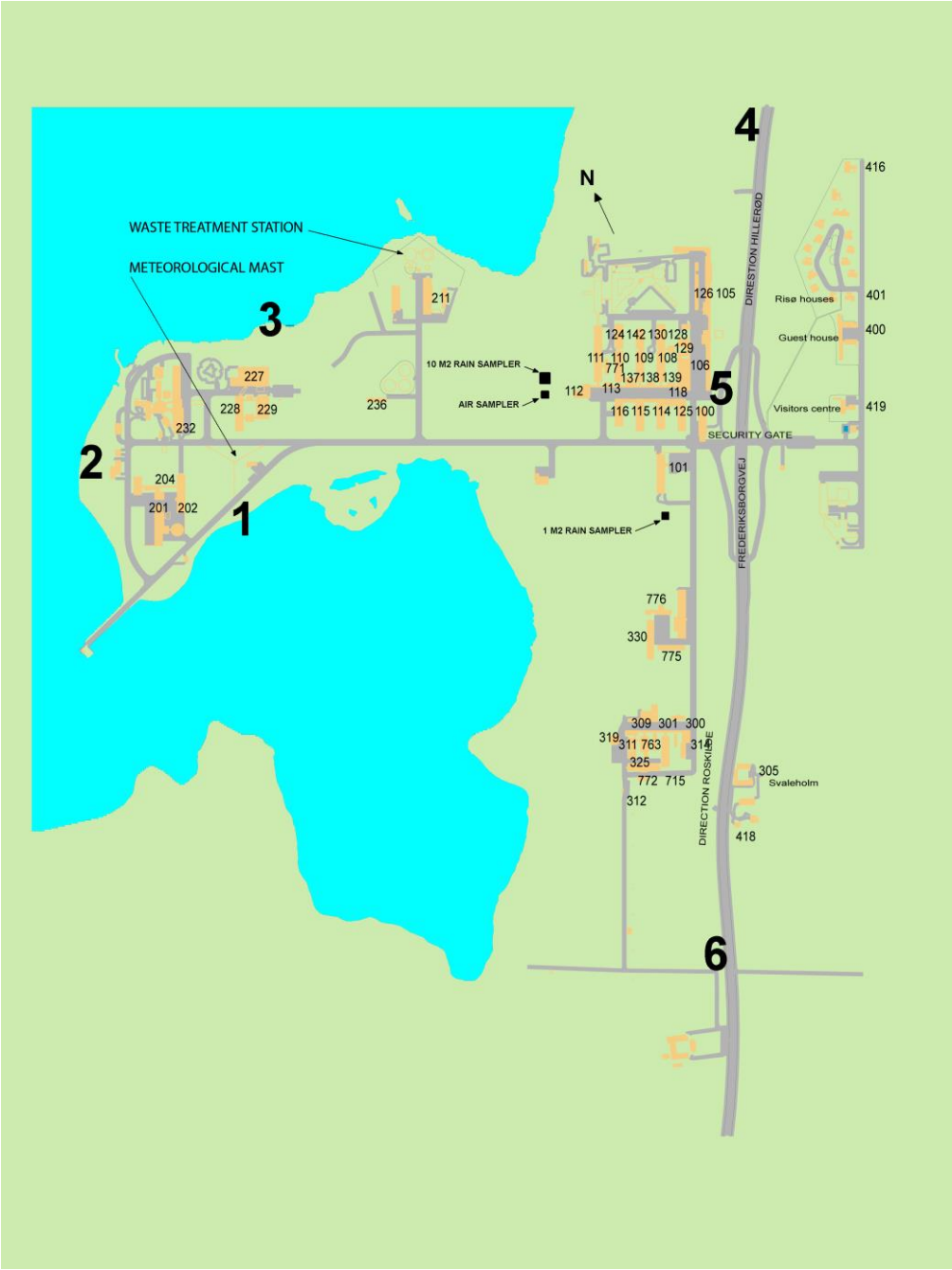

Fig. 8.1. Locations (1-6) for TLD measurements around the border of Risø (cf. Table 8.1).

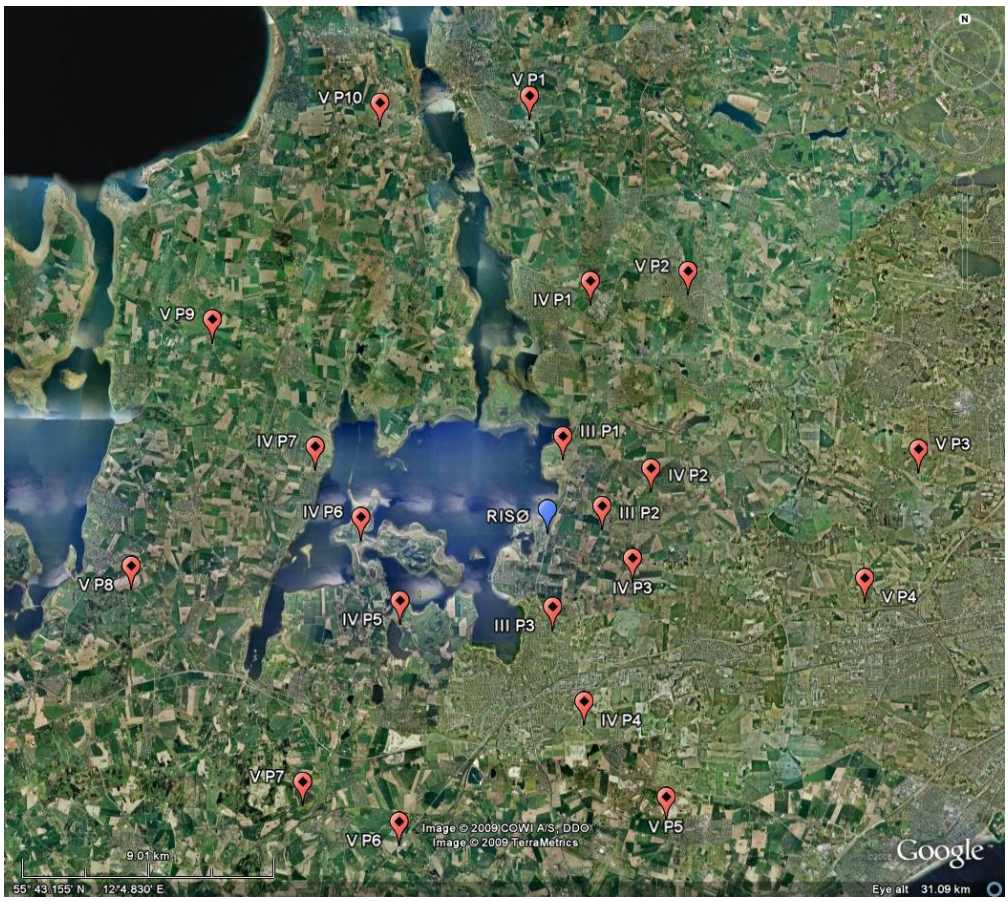

Fig. 8.2. Locations for measurements of background radiation around Risø in Zones III, IV and V.

Center for Nuclear Technologies is Denmark's national competency center for nuclear technology. With roots in research in the peaceful use of nuclear power, DTU Nutech works with the applications of ionizing radiation and radioactive substances for the benefit of society.

DTU
Center for Nuclear Technologies
Technical University of Denmark

Frederiksborgvej 399
PO Box 49
DK-4000 Roskilde
Denmark
Phone +45 4677 4677
Fax +45 4677 5688

www.dtu.dk